

Assessment of Reservoir Heterogeneity Using Production Type-Curves: A Case Study of the Red River Formation in Harding County, South Dakota and Bowman County, North Dakota

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This work presents results from a reservoir characterization study to identify areas near producing oil wells which could benefit from additional seismic and geological investigations to aid infield drilling. Statistics of drainage shape factors, effective pore volume and drive mechanisms are presented for the Ordovician Red River Formation in the southern Williston Basin. Screening techniques are also presented to aid identification of potential reservoir heterogeneity.

Wells exhibiting heterogeneous behavior can be targets for additional seismic and geological investigations to assess potential for further primary or secondary recovery by new drilling. The integrated use of production type-curves, supplemented with permeability data from drill-stem tests or cores, can produce insights about the degree and nature of reservoir heterogeneity. However, using type-curves developed for the radial-flow case in highly irregular drainage situations can lead to erroneous estimates for kh , S (damage or stimulation) and drained pore-volume. A technique has been developed based upon production decline type-curves and analysis of data from multi-well systems or non-radial drainage areas of unknown shapes. Production decline type-curves based on those previously developed by other authors are applied to solution-gas drive production data from heterogeneous reservoirs in this work. Use of this technique is demonstrated for both simulated and actual field data. The curves have been successfully used to estimate reservoir shape and well drainage areas and are supported by geological-geophysical interpretations of reservoir geometry which are shown by example cases.